PRECEDENTIAL

Filed July 3, 2002

UNITED STATES COURT OF APPEALS
FOR THE THIRD CIRCUIT

Nos. 99-2030/99-2051

MICHELLE S. STECYK, individually, as Executrix of the ESTATE OF ANTHONY J. STECYK, JR., and on behalf of ANTHONY L. STECYK, minor

v.

BELL HELICOPTER TEXTRON, INC.; DOES, 1 THOUGH 5, INCLUSIVE; UNITED STATES OF AMERICA

(District Court #94-cv-1818)

DOROTHY L. RAYBURN, individually, as surviving spouse of ROBERT K. RAYBURN, deceased, and on behalf of ALAN M. RAYBURN and JACQUELINE M. RAYBURN, surviving children of ROBERT K. RAYBURN, deceased; ROBERT L. ANDERSON, as Executor for the Estate of ROBERT K. RAYBURN, deceased;

v.

THE UNITED STATES OF AMERICA; BELL HELICOPTER-TEXTRON, INC., a foreign corporation; TEXTRON INC., a foreign corporation; ALLISON GAS TURBINE DIVISION OF GENERAL MOTORS CORPORATION, a foreign corporation; MACROTECH FLUID SEALING, INC., C.D.I. DIVISION MICRODOT, INC., MICRODOT/CDI MICRODOT, INC., MACROTECH/CDI d/b/a MACROTECH, INC.; ALLISON ENGINE COMPANY, INC.;

(District Court #94-cv-4342)

KATHLEEN K. MAYAN, individually, as surviving spouse of GERALD W. MAYAN, DECEASED, and as Administratrix of the Estate of GERALD W. MAYAN, deceased, and on behalf of JAMES PAUL MAYAN, GERALD VINCENT MAYAN II and JAKE DANIEL MAYAN, surviving sons of GERALD W. MAYAN, deceased

v.

THE UNITED STATES OF AMERICA; BELL HELICOPTER-TEXTRON, INC.; TEXTRON, INC.; ALLISON GAS TURBINE DIVISION OF GENERAL MOTORS CORPORATION; MACROTECH FLUID SEALING, INC. dba MACROTECH, INC.; MACROTECH/CDI; MICRODOT INC.; MICRODOT/CDI, and/or C.D.I. DIVISION MICRODOT, INC.; ALLISON ENGINE COMPANY, INC.

(District Court #94-cv-4343)

Dorothy Rayburn and Kathleen
Mayan,
Appellants (No. 99-2030)

Bell Helicopter Textron Inc.
Appellant (No. 99-2051)

Appeal from the United States District Court
for the Eastern District of Pennsylvania
(D.C. Civil Action Nos. 94-cv-01818/04342/04343)
District Judge: Honorable Eduardo C. Robreno

Argued on March 1, 2001

Before: SLOVITER, NYGAARD and ROTH, Circuit Ju dges

(Opinion filed July 3, 2002)

Steven R. Punian, Esquire (Argued)
Milton G. Sincoff, Esquire
Andrew J. Maloney, III, Esquire
Jacqueline M. James, Esquire
Kreindler & Kreindler
100 Park Avenue
New York, NY 10017

Attorneys for Appellants/Cross-
Appellees Dorothy L. Rayburn and
Kathleen K. Mayan

Patrick J. O'Connor, Esquire
(Argued)
Thomas R. Harrington, Esquire
John F. Mullen, Esquire
James E. Robinson, Esquire
Cozen & O'Connor
1900 Market Street - The Atrium
Philadelphia, PA 19103

Attorneys for Appellee/Cross-
Appellants Bell Helicopter Textron
Inc.

Ralph G. Wellington, Esquire
J. Denny Shupe, Esquire
Michael J. Colleran, Esquire
Schnader, Harrison, Segal & Lewis
1600 Market Street, Suite 3600
Philadelphia, PA 19103

Attorneys for Appellee
General Motors Corporation

David N. Zeehandelaar, Esquire
(Argued)

Sheryl L. Axelrod, Esquire
Blank, Rome, Cominsky & McCauley
One Logan Square
Philadelphia, PA 19103

Attorneys for Appellee
Macrotech Fluid Sealing, Inc.

OPINION OF THE COURT

ROTH, Circuit Judge:

These wrongful death actions arose out of the July 20, 1992 crash of a V-22 Osprey aircraft near Quantico, Virginia. Plaintiffs are representatives of the estates of two of the seven members of the crew. Defendants designed, manufactured, and tested the Osprey and the components at issue in this case. A jury trial resulted in judgment for defendants. On appeal, plaintiffs challenge several of the District Court's evidentiary rulings.

For the reasons stated below, we will affirm the District Court's final judgment.

I. FACTS

The twin-engine Osprey combines the vertical takeoff and landing capability of a helicopter with the cruising speed and flying capabilities of a fixed wing aircraft. Bell Helicopter Textron, Inc., along with Boeing Vertol Company, designed and developed the Osprey under a contract with the federal government. General Motors Corporation designed and manufactured the engines under a separate contract with the government. Macrotech Fluid Sealing, Inc., manufactured the torquemeter shaft seal, known as the "617 seal," under a subcontract with the Bell-Boeing team.

On July 20, 1992, the Osprey crashed while in the transition stage from airplane to helicopter flight. The Osprey was attempting to land at the Quantico military field after a two hour and forty-four minute flight from Eglin Air Force Base in Florida. The plane's three U.S. Marine pilots, together with four Boeing engineers, were killed.

The accident was investigated by a U.S. Navy Court of Inquiry. The Court of Inquiry's findings were then forwarded to a superior Naval authority for review, referred to as the First Endorsement. The Endorsement became part of the Court of Inquiry Report.

At trial, the District Court admitted the Report, including the Endorsement, into evidence. Both the Court of Inquiry

and the Endorsement agreed that the crash occurred after a flammable fluid was ingested by the aircraft's right engine as the craft was attempting to land. The Court of Inquiry stated that the right torquemeter shaft seal (the 617 seal) was installed backwards and leaked, providing "the most probable primary causal factor for the mishap." However, the Endorsement did "not concur" with this conclusion. The Endorsement stated that improper installation of the 617 seal was only one possible source of the leaked flammable fluid.

Plaintiffs' theory was that the crash was caused by a transmission oil leak past a 617 seal that had been installed backwards by Boeing mechanics. They contended that Bell and Macrotech were negligent in not designing a "Murphy-proof " seal which could not be reversed. While such a "two-way" seal has been installed in subsequent versions of the Osprey, the District Court precluded evidence of this post-incident remedial measure.

For the defense, Bell contended that a 617 seal would not leak even if reversed and presented an alternate theory of causation that the engine failure was caused by hydraulic fluid, not transmission oil.

Bell presented evidence of three separate tests which concluded that a reversed 617 seal did not leak. The first test (1992 test) had been performed by Bell employee Ken Wilson at the request of the Court of Inquiry. The 1992 test, which was discussed in both the Court of Inquiry's findings and the Endorsement, concluded that a reversed 617 seal subjected to the same range of RPMs, torque, power, heat, pressure and tilt angles as the 617 seal on the Osprey did not leak. Plaintiffs' experts criticized the 1992 test in several ways, including challenging the use of "new" seals and contending that the test's one hour and twenty minute duration was too short. Plaintiffs did not object to the admission into evidence of the 1992 test.

The two other reversed 617 seal tests, conducted in 1997 and 1998, were performed at Bell's request by Wilson, who had retired from Bell in 1995. These two tests were

videotaped, and Bell produced these videotapes to plaintiffs five months before trial.

During the defense case at trial, when Bell attempted to elicit testimony from Wilson about the 1997 and 1998 tests, plaintiffs objected based, inter alia, on "unfair surprise." The court excused Wilson and ordered him and defense expert Dr. Thomas Eagar to produce supplemental reports for plaintiffs by 5 p.m. that day, a Friday. Shortly thereafter, the court recessed trial until Tuesday to give plaintiffs the opportunity to consult with their own experts and depose Wilson and Dr. Eagar, if appropriate.

When trial resumed on Tuesday morning, plaintiffs

confirmed that they had received the reports and declined to take any additional depositions. They asked the court to exclude Wilson's videotaped tests on the ground that they were not substantially similar to the conditions on the Osprey. After hearing argument about substantial similarity, the court admitted the 1997 and 1998 tests. At the close of Wilson's testimony, plaintiffs moved to strike his testimony regarding the 1997 and 1998 tests, again on grounds of substantial similarity, and the court denied the motion.

After Wilson testified, Dr. Eagar testified as an expert on failure analysis, testing with respect to failure analysis, and materials science. He presented an alternate theory of causation, opining that the Osprey's engine failure was caused by hydraulic fluid, not transmission oil.

After a six week trial, the jury returned a verdict for the defendants. The District Court denied post verdict motions, and plaintiffs timely appealed to this Court.

II. STANDARD OF REVIEW

The District Court had jurisdiction under 28 U.S.C. S 1332. We have jurisdiction to review the final judgment of the District Court pursuant to 28 U.S.C. S 1291.

We review the District Court's evidentiary rulings principally for abuse of discretion. See General Electric v. Joiner, 522 U.S. 136, 146 (1997) (decision to admit or exclude expert testimony); Glick v. White Motor Co., 458

F.2d 1287, 1294-95 (3d Cir. 1972) (admission or exclusion of tests); see also Inter Med. Supplies, Ltd. v. EBI Med. Sys. Inc., 181 F.3d 446, 464 (3d Cir. 1999) (reviewing district court's admission of evidence for abuse of discretion, but exercising plenary review over evidentiary rulings with legal component); Complaint of Consolidation Coal Co. , 123 F.3d 126, 131 (3d Cir. 1997) (same), cert. denied, 523 U.S. 1054 (1998). To show an abuse of discretion, appellants must show the district court's action was "arbitrary, fanciful or clearly unreasonable." Stich v. United States , 730 F.2d 115, 118 (3d Cir. 1984). We will not disturb a trial court's exercise of discretion unless "no reasonable person would adopt the district court's view." Oddi v. Ford Motor Co., 234 F.3d 136, 146 (3d Cir. 2000).

III. DISCUSSION

Plaintiffs first challenge the District Court's admission of the videotaped 1997 and 1998 tests which concluded that a reversed 617 seal does not leak. Next, the plaintiffs argue that Dr. Eagar's testimony regarding a leak of hydraulic fluid lacked an adequate factual foundation. Finally, plaintiffs contend the District Court erred in precluding evidence of Bell's post-crash two-way seal designs. We address each argument in turn.

A. The Videotaped 1997 and 1998 Tests

As proponents of the videotaped evidence, Bell had to make a foundational showing that the 1997 and 1998 test conditions were substantially similar to conditions on the Osprey. See Glick, 458 F.2d at 1294; Ramseyer v. Gen. Motors Corp., 417 F.2d 859, 864 (8th Cir. 1969). However, as the term suggests, substantial similarity does not require perfect identity between actual and experimental conditions. Experimental evidence may be admitted even if conditions do not perfectly correspond to the conditions at issue in litigation; dissimilarities may affect the weight of the evidence, but not its admissibility. See id. A ruling on substantial similarity is committed to the sound discretion of the trial judge. Id.

The record reflects that Bell satisfied this threshold of admissibility. Wilson, who conducted the tests, explained the protocol for each test in a written report and testified at length about the tests. The 1997 test used an actual 617 seal installed on a replica shaft and torquemeter housing machined from blueprints of the Osprey. The test consisted of four phases. Each phase ran for eight to ten minutes at pressures of up to 500 psi (pounds per square inch), which was roughly ten times the normal operating pressure on the 617 seal on the Osprey. When oil pressure was applied to the reversed 617 seal in this duplicate housing, the seal did not leak.

The 1998 test used actual Osprey components including a 617 seal, torquemeter shaft and torquemeter housing. This configuration ran under pressure for 18 hours at 114 psi, and the reversed 617 seal did not leak. Wilson testified that centrifugal pressure did not affect the result of the tests. Any minimal additional pressure that would have been generated by centrifugal forces was instead created and surpassed by the additional pressure (500 and 114 psi) exerted in the tests. Faced with this evidence, it was a proper exercise of the District Court’s discretion to admit the 1997 and 1998 tests.

By contrast, plaintiffs did not offer any rebuttal evidence that the tests were not substantially similar to conditions on the Osprey. Instead, plaintiffs’ counsel argued that the 1997 and 1998 tests were conducted in a static environment, as opposed to a dynamic environment where they would be subject to centrifugal forces and vibration. However, as plaintiffs’ counsel admitted at oral argument, they failed to produce a witness, a report, or any evidence to support their argument that the lack of centrifugal forces imposed on the seal rendered the conditions meaningfully dissimilar. Thus, the only evidence before the District Court was defense reports and witness testimony that the tests were substantially similar to conditions on the Osprey. In light of this evidence, we will not disturb the District Court’s exercise of discretion to admit the 1997 and 1998

tests. Any dissimilarities that plaintiffs identified were properly the subject of cross-examination.

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In addition, a review of the record belies plaintiffs' alternate contention that they were unfairly surprised by the tests. The record reflects that plaintiffs had the videotapes five months prior to trial and that their own experts had viewed the videotapes. At trial, when plaintiffs objected based on unfair surprise, the court ordered Bell to produce supplemental reports from Wilson and Dr. Eagar and recessed early on a Friday to give plaintiffs additional opportunities to depose the defense witnesses and consult with their own experts. When proceedings resumed the following Tuesday, plaintiffs had declined to take additional depositions. Plaintiffs argued that the tests were not substantially similar but, as discussed above, offered no evidence to rebut Bell's evidence and support their argument that a lack of centrifugal forces rendered the tests inadmissable. Nor did plaintiffs move for a continuance in order to get the requisite testimony.

In view of the record as set out above, we find no abuse of discretion in the District Court's rulings on the admissibility of this evidence.

B. Dr. Eagar's Testimony

Defense expert Dr. Thomas Eagar opined that the most probable source of flammable fluid which caused the Osprey's engine failure was hydraulic fluid. Plaintiffs contend that Dr. Eagar's testimony regarding a leak of hydraulic fluid lacked an adequate factual basis because there was insufficient evidence of the presence of hydraulic fluid inside the engine.

Under Rule 703 of the Federal Rules of Evidence, experts may rely on facts from firsthand knowledge or observation, information learned at the hearing or trial, and facts learned out of court. Fed. R. Evid. 703.[1] If the facts are of

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1. Rule 703 provides:

> The facts or data in the particular case upon which an expert bases an opinion or inference may be those perceived by or made known to the expert at or before the hearing. If of a type reasonably relied upon by experts in the particular field in forming opinions or inferences upon the subject, the facts or data need not be admissible in evidence.

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the type "reasonably relied upon" by experts in the particular field in forming opinions or inferences upon a subject, the facts or data need not be independently admissible in evidence. Id. See In Re Paoli R.R. Yard PCB

Litig., 35 F.3d 717, 747 (3d Cir. 1994). Rule 705 provides for the disclosure of facts underlying the expert's opinion. Fed. R. Evid. 705;2 see also Fed.R.Civ.P. 26(a)(2)(B) and 26(e)(1) (relating to disclosure in advance of trial of the basis and reasons for an expert's opinion). It is an abuse of discretion to admit expert testimony which is based on assumptions lacking any factual foundation in the record. See Elcock v. Kmart Corp., 233 F.3d 734, 756 n.13 (3d Cir. 2000) (discussing Rules 702, 703, 402 and 403 and stating that foundational requirement for admissibility of expert testimony is found in the "interstitial gaps" among the federal rules). Rule 705, together with Rule 703, places the burden of exploring the facts and assumptions underlying the testimony of an expert witness on opposing counsel during cross-examination. See e.g. Ratliff v. Schiber Truck Co., Inc., 150 F.3d 949, 955 (8th Cir. 1998); Toucet v. Maritime Overseas Corp., 991 F.2d 5, 10 (1st Cir. 1993).

Here, the record reflects a factual foundation sufficient to support Dr. Eagar's opinion that the most probable source of flammable fluid was hydraulic fluid. The record shows that, of the possible fluids involved in the accident, only hydraulic fluid is red. A red residue was found in the torquemeter housing. This red residue was tested for the Court of Inquiry and found to be a good match for hydraulic fluid. There was some hydraulic oil found in front of the engine and it may have gotten into the engine. Finally, a red residue containing hydraulic oil was discovered on the engine air particle separator, adjacent to the engine. Thus, the record reflects sufficient evidence of hydraulic fluid solvent in places it should not have been--

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2. Rule 705 provides:

> The expert may testify in terms of opinion or inference and give reasons therefor without first testifying to the underlying facts or data, unless the court requires otherwise. The expert may in any event be required to disclose the underlying facts or data on cross examination.

outside the engine, near the engine, and in the torquemeter housing--to form the factual foundation for Dr. Eagar's testimony. It was within the discretion of the District Court to admit such testimony.

Once Bell's expert met the foundational requirements for admissibility, the burden shifted to plaintiffs to explore any deficiencies in the expert's sources. A party confronted with an adverse expert witness who has sufficient, though perhaps not overwhelming, facts and assumptions as the basis for his opinion can highlight those weaknesses through effective cross-examination. See Ratliff , 150 F.3d at 955; Toucet, 991 F.2d at 10; cf. Daubert v. Merrell Dow Pharm, Inc., 509 U.S. 579, 596 (1993) ("Vigorous cross-examination, presentation of contrary evidence, and careful instruction on the burden of proof are the traditional and

appropriate means of attacking shaky but admissible evidence."). The District Court properly exercised its discretion in admitting the testimony and permitting appropriate cross-examination of Dr. Eagar.3

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3. We appreciate our dissenting colleague's criticisms of the factual foundation for Dr. Eagar's testimony. These criticisms, however, raise precisely the type of issues that must be resolved by a fact-finder having the benefit of the adversary process. By raising these concerns, the dissent effectively conducts an independent evaluation of the weight of the evidence -- an exercise that we believe exceeds the appropriate boundaries of an abuse of discretion review. While the Federal Rules of Evidence call upon the courts to serve as gatekeepers who independently evaluate the admissibility of expert opinion testimony, they rely upon the discretion of the trial courts -- not the discretion of the courts of appeals. See In re TMI Litig., 193 F.3d 613, 697 (3d Cir. 1999). Because the record contains some factual basis -- albeit shaky -- for Dr. Eagar's testimony, the District Court did not abuse its discretion in performing this gatekeeping function.

Moreover, we disagree with the dissent to the extent it concludes that "no reasonable expert could base an opinion" on Dr. Eagar's factual foundation. In re TMI Litig., 193 F.3d at 697. Such a conclusion would reject implicitly Dr. Eagar's qualification to testify as an expert witness under Rule 702 -- a determination that the plaintiffs do not challenge and that we have no reason to reverse. See Elcock, 233 F.3d at n.13 (explaining the relationship between the foundation requirements of Rule 703 and the qualification requirements of Rule 702).

C. Post-crash Seal Designs

The Federal Rules of Evidence expressly preclude the introduction of evidence of subsequent remedial measures to prove a party's negligence or culpable conduct. Fed. R. Evid. 407.4 Rule 407 rests on the strong public policy of encouraging manufacturers to "make improvements for greater safety." Kelly v. Crown Equipment Co. , 970 F.2d 1273, 1276 (3d Cir. 1992). A manufacturer will be discouraged from making improvements for the greater safety of its products if such changes can be introduced as evidence that the previous designs were defective. Id. Moreover, Rule 407 "operates on the presumption that undue prejudice is likely in certain situations . . . ." Id. at 1277. Thus, courts "routinely exclude evidence of [subsequent remedial measures] to encourage people to take such measures whether or not they are at fault." Petree v. Victor Fluid Power, Inc., 831 F.2d 1191, 1198 (3d Cir. 1987) ("Petree I").

Pursuant to Rule 407, the District Court excluded evidence that a two-way seal was used on the Osprey following the crash. However, because defendants argued that a one-way seal design was reasonable and that a two-way seal was more difficult to install and "not suited for the military environment," Plaintiffs contend that evidence of post incident use of the two-way seal was admissible for

purposes of impeachment.

While the text of Rule 407 permits admission of subsequent remedial measures for impeachment, we have cautioned against permitting the exception to "swallow" the rule. See Petree v. Victor Fluid Power, Inc., 887 F.2d 34, 39

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4. Fed.R.Evid. 407 provides:

> When, after an injury or harm allegedly caused by an event, measures are taken that, if taken previously, would have made the injury or harm less likely to occur, evidence of the subsequent measures is not admissible to prove negligence, culpable conduct, a defect in a product, a defect in a product's design, or a need for a warning or instruction. This rule does not require the exclusion of evidence of subsequent measures when offered for another purpose, such as proving ownership, control, or feasibility of precautionary measures, if controverted, or impeachment.

(3d Cir. 1989) ("Petree II") (impeachment exception may not be used as "subterfuge" to prove negligence). We have recognized that, in light of the strong public policy considerations behind the rule and the risk of undue prejudice, the trial judge should be afforded a healthy deference in preserving both the rule and the exception. Id. Under Rule 407, together with the Rule 4035 unfair prejudice/probative value weighing, the trial court retains broad power to insure that remedial measures evidence is not improperly admitted under the guise of the impeachment exception. Id.

In the instant case, the record contains a significant amount of pre-incident impeaching testimony regarding one-way versus two-way seals. The court admitted considerable testimony and graphic documentation of Bell's receipt, review, and rejection of a pre-crash alternative design of a two-way seal from a vendor, Longhorn Gasket. Plaintiffs cross-examined Bell's witness on Longhorn's two-way seal proposal. The jury saw an exhibit which contained a diagram of Longhorn's two-way seal and Bell's evaluation of the proposal. Using evidence of Bell's rejection of a two-way seal prior to the crash, plaintiffs thus had the opportunity to impeach the defense witness's testimony regarding the reasonableness of the 617 seal's one-way design without resort to prejudicial post-incident evidence.

As we stated earlier, a district court retains considerable discretion in determining whether otherwise excludable remedial measures evidence should be admitted under the impeachment exception. Here, where the evidence of the existence of a two-way seal design prior to the accident was sufficient for plaintiffs to effectively cross-examine the defense witness, it was a proper exercise of the District Court's discretion to exclude highly prejudicial post-incident evidence. In light of the availability of this pre-

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5. Fed.R.Evid. 403 provides:

> Although relevant, evidence may be excluded if its probative value is substantially outweighed by the danger of unfair prejudice, confusion of the issues, or misleading the jury, or by considerations of undue delay, waste of time, or needless presentation of cumulative evidence.

incident impeaching evidence, it was not error for the District Court to exclude the prejudicial post-incident remedial measures.

IV. CONCLUSION

In light of our disposition of plaintiffs' claims, Bell's cross appeal is moot. Likewise, we need not address Macrotech's alternative grounds for affirmance. For the foregoing reasons, we will affirm the final judgment of the District Court.

SLOVITER, Circuit Judge, dissenting:

It is an important evidentiary principle, one that the majority recognizes, that "[i]t is an abuse of discretion to admit expert testimony which is based on assumptions lacking any factual foundation in the record." Maj. Op. at 10. The District Court in this case allowed an expert to give testimony that was "wholly lacking foundation in the record." Elcock v. Kmart Corp., 233 F.3d 734, 754 (3d Cir. 2002). In so doing, the District Court abused its discretion. Because the majority finds that "[t]he District Court properly exercised its discretion in admitting [this] testimony," Maj. Op. at 11, I dissent.

I.

DR. EAGAR'S TESTIMONY CONCERNING CAUSE OF CRASH

Defendants, the designers, manufacturers and testers of the troubled Osprey aircraft, argue that the crash at issue in this case was caused when hydraulic fluid entered the right engine of the aircraft due to a loose hydraulic fitting. In support of this theory, Defendants offered the testimony of Dr. Thomas Eagar. App. at 1552-1722. Dr. Eagar testified that "the most probable source of fuel[which caused the aircraft's engine to fail] was the hydraulic fluid." App. at 1627. Dr. Eagar said that he based that opinion on the presence of red residue "all over the torque[ ]meter housing," App. at 1627, the gas chromatography detailed in the GM/Allison Accident Investigation and Residue Chemical Analysis Report (henceforth, GM/Allison Report), see App. 2380-90, the amount of fluid in the right nacelle,

the burn damage in the upper nacelle, and the fact that there was a loose nut on the hydraulic fitting. App. at 1627-28.

Federal Rule of Evidence 703 states that "[t]he facts or data in the particular case upon which an expert bases an opinion or inference may be those perceived by or made known to the expert at or before the hearing." Fed. R. Evid. 703. This rule imposes upon a trial judge the obligation to determine whether to admit expert testimony:

> Rule 703 thus focuses on the data underlying the expert's opinion. . . . "[W]hen a trial judge analyzes whether an expert's data is of a type reasonably relied on by experts in the field, he or she should assess whether there are good grounds to rely on this data to draw the conclusion reached by the expert." If the data underlying the expert's opinion are so unreliable that no reasonable expert could base an opinion on them, the opinion resting on that data must be excluded. The key inquiry is reasonable reliance and that inquiry dictates that the "trial judge must conduct an independent evaluation into reasonableness." Rule 703's reliability standard is similar to Rule 702's reliability requirement, i.e., "there must be good grounds on which to find the data reliable."

In re TMI Litig., 193 F.3d 613, 697 (3d Cir. 1999) (alteration in original) (citations omitted) (quoting In re Paoli R.R. Yard PCB Litig., 35 F.3d 717, 748-49 (3d Cir. 1994)).

Appellants, plaintiffs below, contend that Dr. Eagar's opinion that the crash was caused by a hydraulic fuel leak lacked a factual basis and therefore the District Court should have excluded it. Specifically, they contest each of the three main factual predicates for Dr. Eagar's opinion: (1) the presence of hydraulic fluid inside the engine, (2) the timing of the hydraulic fluid leak, and (3) the loose nut found on a hydraulic fitting. I discuss each of these in turn.

A. Hydraulic Fluid in the Engine

At trial, a defense attorney, in discussing Dr. Eagar's testimony, said that "the critical evidence . . . is that the [GM/]Allison [R]eport shows profuse quantities of hydraulic oil in the engine, and that's evidence of the fact that it was hydraulic . . . oil that caused the engine to fail." App. at 1623. Appellants challenge the "critical" factual support for Dr. Eagar's testimony that hydraulic fluid was found inside the engine. I agree with Appellants. The record evidence, in particular the GM/Allison Report, does not indicate that hydraulic oil was found inside the engine.

The key page of the report contained a number of findings. See App. at 2389. It indicated that infra-red scans of a red residue, taken from the engine, showed"some

similarities" to hydraulic fluid, "but no definitive match could be made." App. at 2389. Instead, the residue contained glycol ether, which Dr. Eagar conceded"is indicative of transmission oil." App. at 1922. This is consistent with Appellants' theory that transmission oil, rather than hydraulic fluid, was dumped into the engine. Further, gas chromatography of a residue taken from the torquemeter housing "indicated a reasonable agreement" to hydraulic fluid, and "suggest[ed] that[it] was composed of engine oil and hydraulic fluid." App. at 2389. However, Dr. Eagar admitted at trial that the torquemeter housing was outside the engine. See App. at 1924. Additionally, an earlier section in the GM/Allison Report summarized the findings -- that hydraulic oil could only be identified outside the engine:

> The compressor blade track areas [inside the engine] showed a red trace which was not sufficient to determine its source. The material . . . in the torquemeter [outside the engine] housing, also red in color, is a good match to the hydraulic fluid known to be in use on the aircraft hydraulic system.

App. at 2385. In fact, the report concluded that the red residue found inside the engine "was most probably the flame sprayed compressor blade track material" and not hydraulic oil. App. at 2388. Therefore, the only data in the report that even remotely suggested that hydraulic oil was found inside the engine was at best inconclusive. By the report's own terms, "no definitive match could be made." App. at 2389.

Additionally, in one of their briefs, Defendants suggest that other analyses revealed hydraulic oil in the Engine Air Particle Separator ("EAPS"). Br. of Bell Helicopter at 10. However, there are no reports in the record that support this assertion. Instead, Bell cites to the GM/Allison Report, which merely states that "[t]he only remaining source potential is from a non-engine source entrained in the inlet airstream," App. at 2385, and Dr. Eagar's own testimony, App. at 1584. In any event, as the EAPS is outside the engine, see App. at 1907, this does not support Dr. Eagar's conclusion that there was hydraulic fluid in the engine.

B. Timing of the Hydraulic Leak

Appellants also challenge Defendants' evidence concerning the timing of the hydraulic leak that Dr. Eagar claimed caused the crash. Dr. Eagar claimed that the aircraft "lost over a gallon of [hydraulic] fluid" while in flight. App. at 1628. Appellants concede that a leak occurred. However, they argue that the hydraulic leak resulted from, rather than caused, the engine surges and resulting failures. As evidence for this, Appellants rely on

the time-line from the Court of Inquiry Report, App. at 2280-372, that is based on data from the plane's flight data recorder. According to the Court of Inquiry Report, the first hydraulic system failed "due to a leak" which occurred almost twenty-seven seconds after the first engine surge, App. at 2316, which had occurred when "a flammable substance was consumed by the engine." App. at 2315. In addition to data from the Osprey's flight data recorder, other evidence discussed in the Court of Inquiry Report suggests that hydraulic leakage occurred after engine failure. This evidence contributed to the report's conclusion that oil from the proprotor gearbox got into the aircraft's engine. See, e.g., App. at 2363.

Dr. Eagar rejected the conclusion of the Court of Inquiry Report and its reliance on the flight data recorder. He explained that the Osprey's computer system only detected when a system failed; it did not detect when a leak began. App. at 1929-30. He testified that a leak could be present "for up to 43 seconds before [it] gets big enough for the system to detect it." App. at 1930. Defendants, however, failed to present any evidence corroborating Dr. Eagar's description of how the Osprey's systems detected hydraulic leaks. Therefore, his claim about the timing of the hydraulic leak and his use of this claim to support his conclusion that the hydraulic leak played a causal role in the crash amount to little more than unsupported assertions.

C. Loose Nut

Finally, Appellants challenge Dr. Eagar's conclusions concerning the loose hydraulic nut found after the crash. According to Dr. Eagar's testimony:

> I knew there was a loose nut . . . they had problems with hydraulics, they had been having leaks in hydraulics for six months ahead of time, and I specifically told the jury that I could not point out the exact location of this leak except I believed it was in the upper nacelle.

App. at 1817. Dr. Eagar also testified that he had"no direct evidence" that the hydraulic nut in question was the source of the leak, nor did he have further evidence of any other loose nuts. App. at 1628 ("We don't know that that loose nut on the hydraulic fitting was the source of the leak."). He merely testified that the loose nut could explain the hydraulic leak. App. at 1932-33. Thus, even Dr. Eagar failed to suggest that the loose nut was the probable source of the crash. Further, the Court of Inquiry Report found the loose hydraulic nut was caused by the impact of the aircraft's crash. App. at 2332. A Boeing report agreed, finding that "the looseness resulted from a mechanical overload at impact." App. at 2393.

D. Summary

The established factual basis for Dr. Eagar's testimony can be described as follows: (1) gas chromatography indicates that hydraulic fluid was found outside the engine, (2) hydraulic fluid is red, and a red residue was found inside the engine, and (3) a loose hydraulic fitting was found in the aircraft wreckage. The remaining "facts" presented by Defendants are either flatly contradicted by the record or are merely unsupported assertions by Dr. Eagar. The evidence in the record fails to provide a reasonable factual basis for Dr. Eagar's opinion that the crash probably resulted from a hydraulic fluid leak.

II.

I agree with the majority opinion that our standard of review for evidentiary rulings is "principally for abuse of discretion." Maj. Op. at 6. Such a review is not, however, an "empty exercise." Koon v. United States , 518 U.S. 81, 98 (1996) (discussing abuse of discretion standard). This court's precedents and those of the Supreme Court as they relate to expert testimony require a district court to

" 'examine the expert's conclusions in order to determine whether they could reliably flow from the facts known to the expert and the methodology used.' " Oddi v. Ford Motor Co., 234 F.3d 136, 146 (3d Cir. 2001) (quoting Heller v. Shaw Indus., Inc., 167 F.3d 146, 153 (3d Cir. 1999). See also Gen. Elec. Co. v. Joiner, 522 U.S. 136, 146 (1997) ("[N]othing in either Daubert or the Federal Rules of Evidence requires a district court to admit opinion evidence that is connected to existing data only by the ipse dixit of the expert."); Tyger Constr. Co., Inc. v. Pensacola Constr. Co., 29 F.3d 137, 142 (4th Cir. 1994) ("An expert's opinion should be excluded when it is based on assumptions which are speculative and are not supported by the record.") (citing E. Auto Distribs., Inc. v. Peugeot Motors of Am., 795 F.2d 329, 337 (4th Cir. 1986). Such an examination may lead a court to the conclusion that "there is simply too great a gap between the data and the opinion offered." Gen. Elec., 522 U.S. at 146. There may be a natural tendency of judges, when presented with a technical question and a reasonable sounding expert witness, to admit the evidence and let the jury decide the issue. But we have a responsibility that we may not shirk. A district court abuses its discretion if it admits expert testimony that lacks an adequate factual basis.

In most cases, the lack of factual support for an expert opinion affects its weight rather than its admissibility. However, based upon my review of the record, there simply is no factual support for Dr. Eagar's conclusion that a hydraulic fluid leak caused the crash. This goes directly to the admissibility of Dr. Eagar's testimony, as Defendants in effect admitted when they explicitly conditioned the admissibility of Dr. Eagar's testimony on that fact. App. at 1623 (describing the existence of "profuse quantities of hydraulic oil in the engine" as "critical" evidence on which

Dr. Eagar's testimony was based). While the evidence does indicate that hydraulic fluid leaked outside the engine and that a hydraulic nut was loose after the crash, Appellants present ample evidence -- including the Osprey's flight data recorder, the Court of Inquiry Report, and a post-crash analysis by Boeing -- that these did not cause the crash, but rather resulted from it. In contrast, Defendants present no further evidence other than the unsupported assertions

and theories of Dr. Eagar. Even when viewed in a light most favorable to Defendants, the evidence merely suggests the remote possibility that a hydraulic fluid leak may have caused the Osprey's crash. Dr. Eagar's ultimate opinion "that the most probable source of [engine failure] was the hydraulic fluid," App. at 1627, was merely speculation and without factual support. The District Court abused its discretion in admitting this part of his testimony.

The majority's analysis of the factual basis for Dr. Eagar's testimony simply recapitulates the District Court's mistake of accepting Dr. Eagar's claim that the record supports his view. The majority summarizes what it sees as the record support for Dr. Eagar's opinion on the cause of the crash as follows:

> the record reflects a factual foundation sufficient to support Dr. Eagar's opinion that the most probable source of flammable fluid was hydraulic fluid. The record shows that, of the possible fluids involved in the accident, only hydraulic fluid is red. A red residue was found in the torquemeter housing. This red residue was tested for the Court of Inquiry and found to be a good match for hydraulic fluid. There was some hydraulic oil found in front of the engine and it may have gotten into the engine. Finally, a red residue containing hydraulic oil was discovered on the engine air particle separator, adjacent to the engine. Thus, the record reflects sufficient evidence of hydraulic fluid solvent in places it should not have been--outside the engine, near the engine, and in the torquemeter housing--to form the factual foundation for Dr. Eagar's testimony.

Maj. Op. at 10-11. Because the majority comes to the conclusion that the record provides a basis for Dr. Eagar's testimony, it found that the District Court did not abuse its discretion in admitting his testimony on this point. In contrast, on my examination of the record evidence, Dr. Eager's testimony concerning the likely cause of the crash is without basis. For this reason, I respectfully dissent.

A True Copy:
Teste:

Clerk of the United States Court of Appeals
for the Third Circuit